Questions 35, ~~36~~, 38, 41, 43, 44, ~~49~~, 51, 52, ~~53~~, 54, 85, 95a,c

35) a. 1650 kJ **(shouldn't need calculator)** b. 826 kJ **(shouldn't need calculator)**

c. $$\frac{1.00\text{ g Fe}}{} \times \frac{1\text{ mol Fe}}{55.85\text{ g Fe}} \times \frac{-1652\text{ kJ}}{4\text{ mol Fe}} = \textit{\textbf{7.36 kJ released}}$$

d. 10.0g Fe = -73.6 kJ (10x the previous problem)

$$\frac{2.00\text{ g }O_2}{} \times \frac{1\text{ mol }O_2}{32.00\text{ g }O_2} \times \frac{-1652\text{ kJ}}{3\text{ mol }O_2} = \textit{\textbf{34.4 kJ released}}$$

38) a. $$\frac{1.00\text{g }CH_4}{} \times \frac{1\text{ mol }CH_4}{16.034\text{g }CH_4} \times \frac{-891\text{ kJ}}{1\text{ mol }CH_4} = \textit{\textbf{55.5 kJ released}}$$

b. $$P V = n R T$$
$$(0.974\text{ atm})\ 1000\text{L} = n\ (0.08206)\ 298\text{K}$$

$$n = \frac{39.82\text{ mol }CH_4}{} \times \frac{-891\text{ kJ}}{1\text{ mol }CH_4} = \textit{\textbf{55.5 kJ released}}$$

41) Water will require the most energy because it has the highest specific heat

$$q = m\ \Delta T\ c$$
$$q = 25.0\ (22.0)\ 4.18 \qquad \textit{\textbf{q = 2.30 x 10}}^{3}\textit{\textbf{ J}}$$

Hg will have the largest temp. change because it has the lowest spec. heat

$$10{,}700\text{J} = (550.\text{g})\ \Delta T\ (.14\text{ J/g/}^{o}\text{C})$$
$$\boldsymbol{\Delta T = 140\ ^{o}C}$$

43) $$133 = 5.00\ (29.9)\ c$$
$$\boldsymbol{c = 0.890\ J/g/^{o}C}\ \textit{\textbf{(aluminum)}}$$

44) $$585\text{ J} = 125.5\text{g}\ (33.5^{o}\text{C})\ c$$

$$c = \frac{0.139\text{ J}}{1\text{ g }^{o}\text{C}} \times \frac{200.59\text{ g Hg}}{1\text{ mol Hg}} = 27.9\text{ J/mol/}^{o}\text{C Hg}$$

51) $$q = m\ \Delta T\ c$$
$$q = 100.0\text{g}\ (0.80^{o}\text{C})\ 4.18\text{J/g/}^{o}\text{C} \qquad q = 330\text{ J}$$

$$\frac{0.0500\text{ L}}{} \times \frac{0.100\text{ mol }AgNO_3}{1\text{ L}} \times \frac{1\text{ mol AgCl}}{1\text{ mol }AgNO_3} = 0.0050\text{ mol AgCl}$$

$$\frac{330\text{ J}}{0.0050\text{ mol AgCl}} \times \frac{1\text{ kJ}}{1000\text{ J}} = \textit{\textbf{- 66 kJ/mol or 66 kJ/mol released}}$$

52) $q = m \Delta T c$

$q = 76.6g\ (-1.66^{o}C)\ 4.18 J/g/^{o}C$ $q = 532\ J$ absorbed from surroundings

$$\frac{532\ J}{1.60\ g\ NH_4NO_3} \left| \frac{80.05\ g\ NH_4NO_3}{1\ mol\ NH_4NO_3} \right| \frac{1\ kJ}{1000\ J} =$$ ***26.6 kJ/mol NH_4NO_3 dissolved***

54) 2 moles of HCl are reacted for every 1 mole of $Ba(OH)_2$.
Since the amount of HCl used is less than double the amount of $Ba(OH)_2$, HCl is the limiting reactant.

$$\frac{0.100\ L}{} \left| \frac{0.500\ mol\ HCl}{1\ L} \right| \frac{-118\ kJ}{2\ mol\ HCl} = 2.95\ kJ\ released$$

$q = m \Delta T c$

$2{,}950J = 400.0g\ (\Delta T)\ 4.18J/g/^{o}C$ $\Delta T = 1.76\ ^{o}C$

Final temp = 26.8 ^{o}C

85) $H^+{}_{(aq)} + OH^-{}_{(aq)} \longrightarrow H_2O_{(l)}$

Both reactants react in a 1:1 ratio. Since there is less NaOH available, it is the limiting reactant.

$$\frac{0.150L}{} \left| \frac{0.500\ mol\ NaOH}{1\ L} \right| \frac{-56\ kJ}{1\ mol\ HCl} = 4.2\ kJ\ released$$

95) a. $C_{12}H_{22}O_{11\ (s)} + 12O_{2\ (g)} \longrightarrow 12CO_{2\ (g)} + 11H_2O_{(l)}$

b. $$\frac{-24.00\ kJ}{1.46\ g\ sugar} \left| \frac{342.30\ g\ sugar}{1\ mol\ sugar} \right. = -5630\ kJ/mol$$

c. Same (-5630 kJ/mol)